Biological Evaluation of Ash Trees at Berlin Lake

Prepared By:

Richard M. Turcotte
Supervisory Entomologist

And

Ivich Fraser
Entomologist

USDA Forest Service
Northeastern Area State and Private Forestry
Forest Health Protection
180 Canfield Street
Morgantown, WV 26505

Prepared For:
U.S. Army Corps of Engineers
Berlin Lake
Mahoning County, Ohio
April 2015
(3413 NA-15-05)

Table of Contents

Cover Photo 1
(need source reference)Abstract 1
Purpose and Need 2
Project Location Description 2
Project Objectives 3
Project Methods 4
ARCMAP Data 4
Ash Survey 4
Results 5
Ash Tree Survey 5
Discussion 5
Management Alternatives 6
Alternatives 6
No Action Option 6
Intervention Options 6
Chemical Insecticide Option 6
Biological Control 7
Recommendations 7
Species Evaluation 7
References 9

Cover Photo
Debbie Miller, USDA Forest Service, Bugwood.org

Abstract
During the summer and fall of 2014, personnel from the U.S. Army Corps of Engineers, Pittsburgh District joined Forest Health Protection personnel from the Forest Service, U.S. Department of Agriculture, Northeastern Area State and Private Forestry Field Office in Morgantown, WV, to conduct a survey to detect emerald ash borer (EAB), *Agrilus planipennis* (Coleoptera: Buprestidae), at the Berlin Lake (BL) in Mahoning County, Ohio. The purpose of the survey was to see if EAB is present and determine the need for management activities in the BL. Since EAB has been found and is actively impacting the ash resource, we recommend that the BL develop a comprehensive ash management plan and that a chemical suppression/prevention treatment plan be put into place to protect high-value ash (*Fraxinus* spp.) trees. We also recommend the release of biological control agents.

Purpose and Need
The Forest Health Protection unit of the Forest Service's Northeastern Area State and Private Forestry Field Office (MFO) in Morgantown, WV, received a request from Stephen Rutkowski, Natural Resource Specialist with the U.S. Army Corps of Engineers (COE), Pittsburgh District, who was concerned about declining ash within the Berlin (BL). The MFO addressed the request to investigate BL for signs or symptoms of EAB and identify any significant issues that might occur as a result of borer activity within the BL. The MFO also evaluated what management options are available to protect and maintain the ash resources at the BL.

Project Location Description
Berlin Lake is located in northeastern Ohio in Mahoning County, Ohio, (41º00'N, 80º59'W). This COE project covers approximately 8,000 acres (figure 1). The project was authorized by an Act of Congress in 1938 as part of a flood damage reduction project in the Pittsburgh District. This project is part of a flood control system for the Mahoning River Valley as well as for the Beaver and Upper Ohio River systems.

Berlin Lake lies in the Appalachian Mixed Mesophytic Forest type (Ricketts et al. 1999) within the Erie Drift Plain U.S. EPA Level III ecoregion (http://www.cec.org/ecosystems). This area is dominated by sugar maple (*Acer saccharum* Marsh.) and American beech (*Fagus grandifolia* Ehrh.), with some elm (*Ulmus* L.) and ash (*Fraxinus* L.) swamp forests growing in the damper lowland areas (Wiken and others 2011).

Situated at Berlin Lake is the 200 acre Mill Creek Recreation Area which includes 348 campsites. The diversity of campsites, from wooded waterfront sites to grassy spots in the sun, is an ideal family campground. Facilities provided include flush toilets, hot showers, a large boat launching ramp, a limited number of electric hookup sights, and a sanitary disposal station. A 6.32 acre Day Use Area is located within the campground which includes a pavilion and large playground area for the public to use for special events and day to day recreation activities.

Approximately 4,928 land acres are available for public hunting. Wildlife management at Berlin Lake provides for the maintenance and protection of existing woodlands, establishment of regular crop rotations, improvement of open fields for nesting, and establishment of food patches for general wildlife use. Permanent wildlife cover has been provided by planting trees and shrubs along field borders and in odd areas and by establishing brushy field dividers. The project also provides communities downstream with a clean and dependable water supply and has helped to alleviate pollution problems along the Mahoning River Valley.

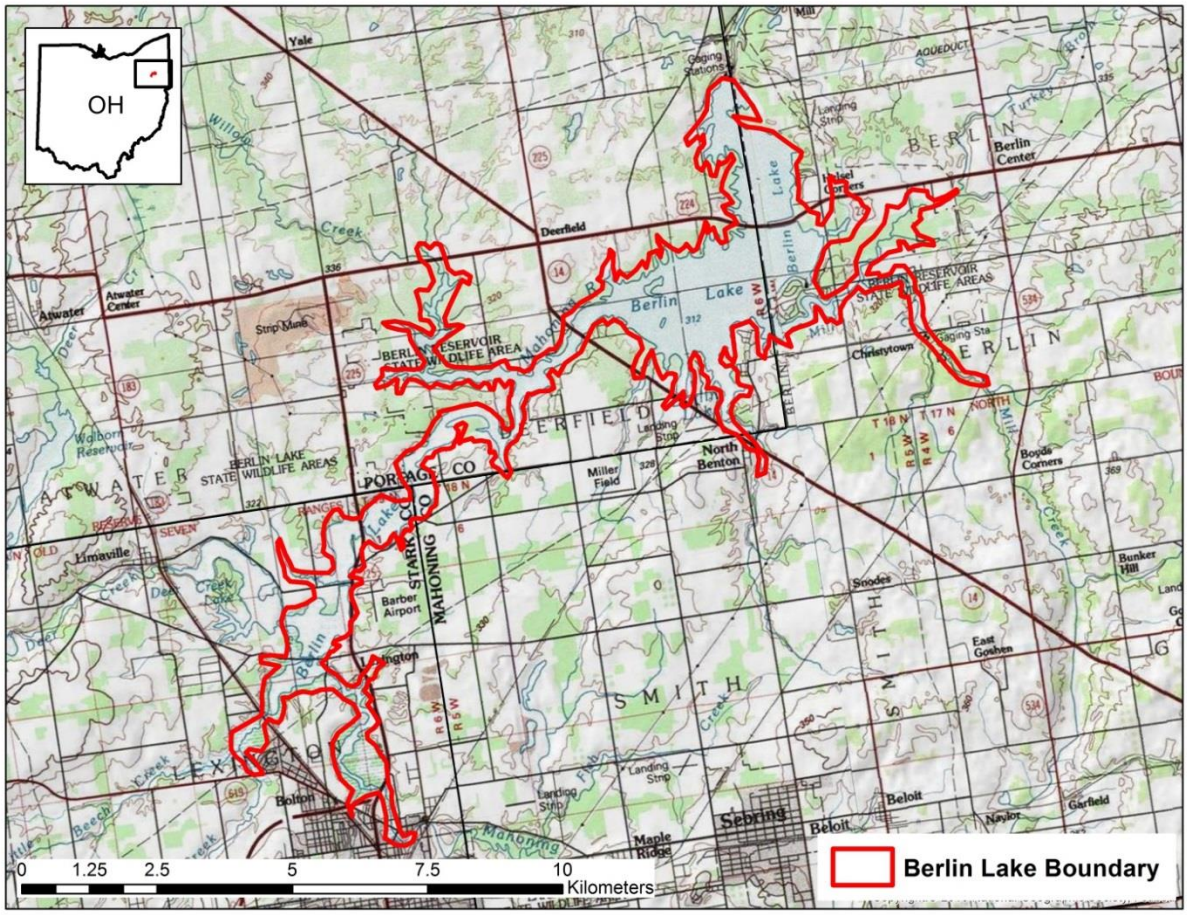

Figure 1. Berlin Lake and Dam in Mahoning County, Ohio.

Project Objectives

The objectives for this evaluation were to 1) determine whether or not EAB was present and active within the project, 2) assess the location and extent of ash within the project, and 3) determine the need for ash treatments to protect and maintain the ash resources within the BL.

Project Methods

ARCMAP Data

We used ARCMAP® data provided by the U.S. Army Corps of Engineers for the boundary and worked with COE staff to digitize and break the area into blocks based on use (e.g. campgrounds; figure 2). These boundary areas were then overlaid with National Agricultural Imagery Program data and Google earth imagery, which were used to digitize tree cover, calculate acreage, and define survey blocks.

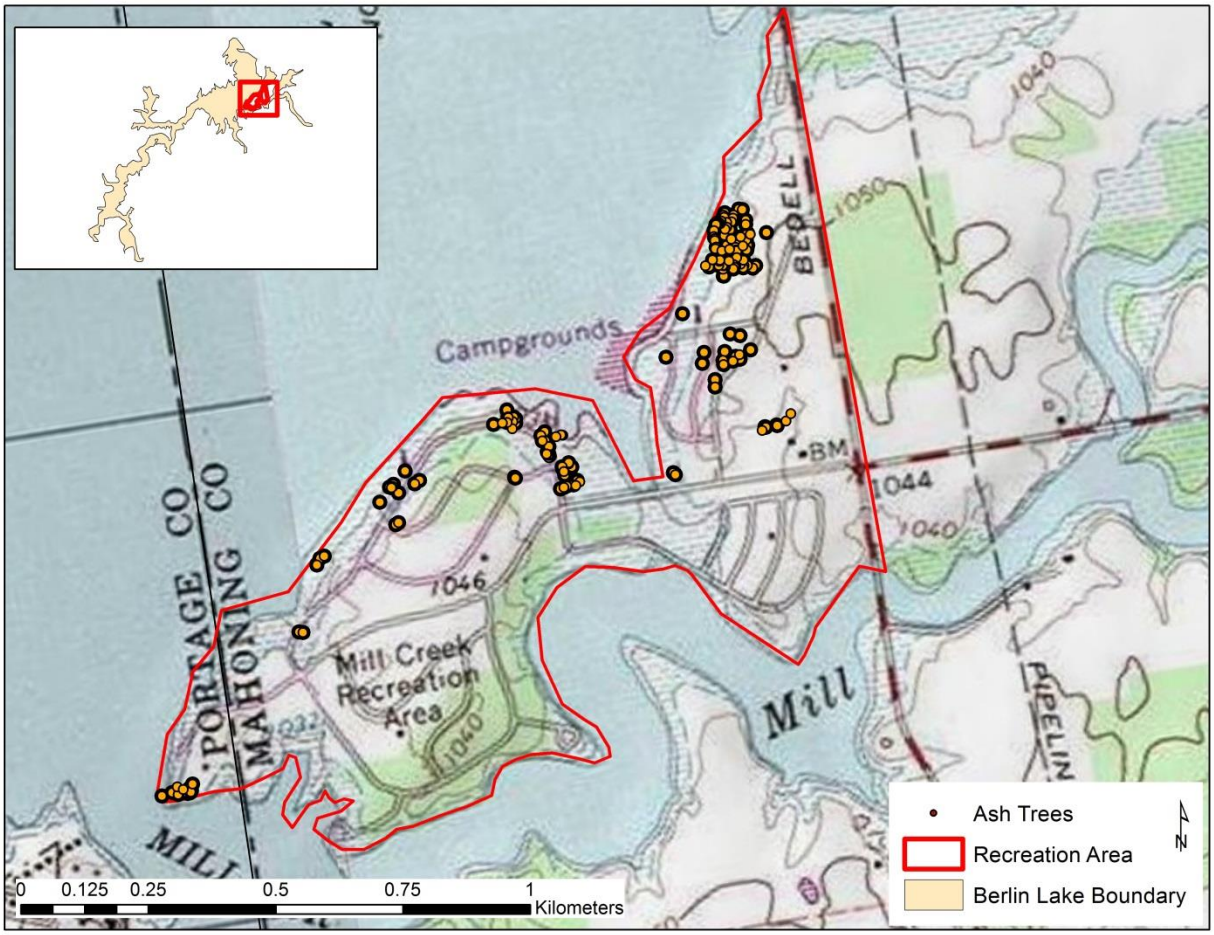

Figure 2. Survey map for ash trees at Berlin Lake, Mill Creek Recreation Area.

Ash Survey

In the summer and fall of 2014, BL staff conducted an intensive ash inventory of the campground (figure 2). Select ash trees ≥ 1 inch in diameter at breast height (d.b.h., measured at 4.5 ft. above the ground) were identified; assigned a size class; visually inspected for signs and symptoms of EAB (e.g. woodpecker activity, D-shaped exit holes, serpentine galleries); and had their geocoordinates recorded using a hand-held GPS unit.

Results

Ash Tree Survey

The emerald ash borer was found to be present and causing tree mortality at the BL. Field surveys identified 204 ash trees within the campground (figure 2). Of the 204 ash trees inventoried, 162 were alive and 27 were dead. There were 15 ash stumps present, which was the result of ash mortality from EAB attacks. The average d.b.h. for live ash trees was 14 ± 6.4 inches (figure 3); live trees ranged in size from 3.0 to 39.0 inches d.b.h. Woodpecker activity was noted on 29 percent of the tallied ash trees, and D-shaped exit holes were found on 19.7 percent of the ash trees. In total, it is predicted that at least 33 percent of the ash surveyed in 2014 at the BL are infested with EAB (figure 3). This is likely a significant underestimate because EAB is difficult to detect during the early stages of attack on a tree.

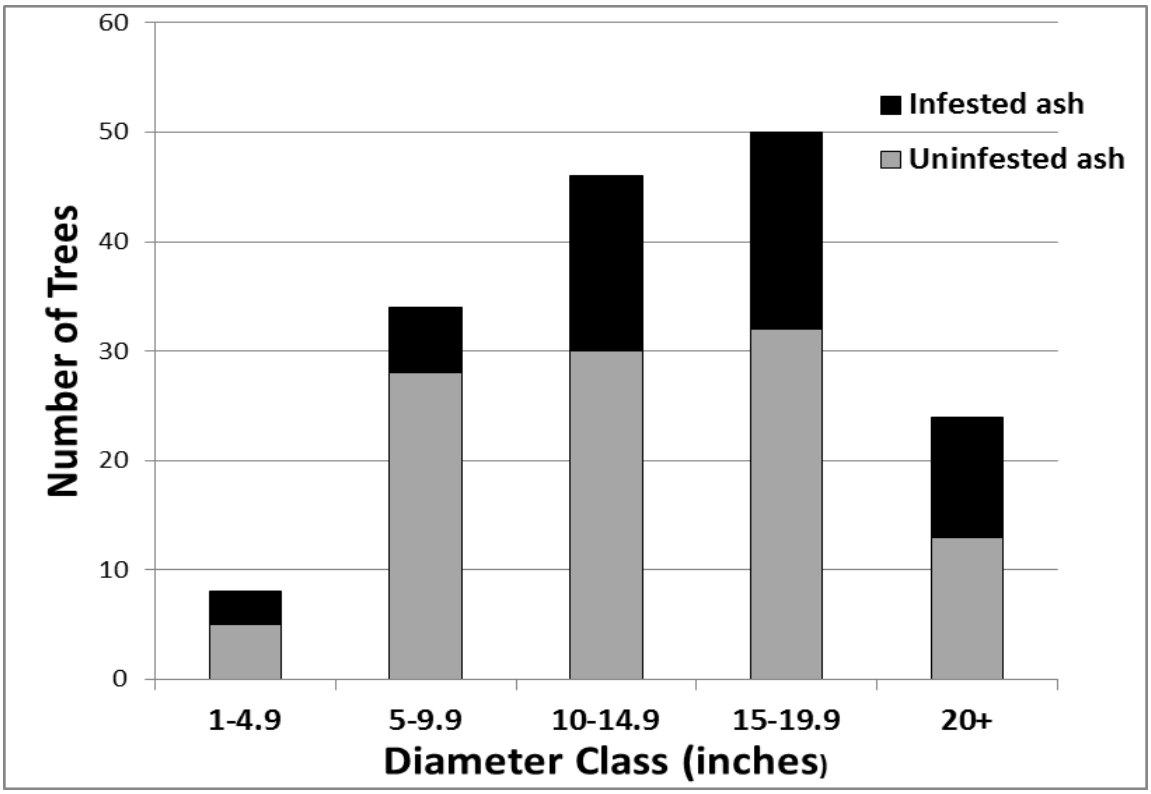

Figure 3. Size distribution of ash within the Mill Creek Recreation Area at Berlin Lake.

Discussion

The main objectives of this evaluation were to determine whether EAB was present, inventory the area, and evaluate the need for EAB management activities. Because EAB is currently present and active at the project, we recommend that the BL develop a comprehensive vegetation management plan that includes preemptive ash removal (e.g. removal of ash with poor form or defects, or removal of ash to lessen EAB population buildup); chemical treatments; removal of infested ash trees (e.g. hazard trees and trees beyond the chemical treatment stage); biological control releases; and replanting to ensure that a sustainable forest will continue at BL.

Management Alternatives

For 2015, three options have been evaluated for managing EAB at the BL. The intervention options are offered based on the following objectives: 1) protect high-value ash trees and 2) protect native woodland ash trees. Each option is discussed below.

Alternatives

Alternative 1.	No action
Alternative 2.	Treat all landscape and campground ash trees and release biological control agents.
Alternative 3.	Limit treatments to all landscape and campground trees >15 inches d.b.h. and release biological control agents.

No Action Option

In this option emerald ash borer is allowed to infest susceptible ash trees within the project. Should this option be selected, it is likely that all susceptible ash trees would be attacked and die as a result of EAB. This would result in the loss of not only high value trees but native woodland trees which would result in hazard trees in public areas, and a reduction in overstory canopy and soft mast production in these areas.

Intervention Options

Chemical Insecticide Option

The second and third options involve using chemical insecticides to prevent and control EAB. Herms and others (2014) reviewed chemical control options for EAB, which include noninvasive systemic basal trunk sprays, soil-applied systemic insecticides, trunk-injected systemic insecticides, and protective cover sprays.

- Dinotefuran (Safari®) is labeled for controlling EAB and has shown variable results. It is sprayed on the lower 5 or 6 feet of trunk.
- Soil injection of imidacloprid has shown variable results and requires careful attention to soil conditions and tree d.b.h. Soil injections should be applied 2-4 inches below the soil surface to stay available to feeder roots, the soil should be moist to facilitate uptake, and chemical amounts should be increased or combined with other treatment methods for trees larger than 15 inches d.b.h.
- Trunk injection of emamectin benzoate in mid-May or early June provides the most consistent control of EAB, according to test trials at Michigan State and Ohio State Universities. This was the only treatment that provided multiple years of protection (up to 3 years).
- Protective cover sprays have been shown to prevent EAB from entering trees in Michigan State University studies, but have no effect on larvae feeding under the bark. Spraying the entire tree is most effective, but there is considerable drift associated with this process.

- A natural product, azadirachtin, is also available formulated as TreeAzin™, which has the potential for systemic control of EAB. This product is a natural tetranortriterpenoid compound extracted from the seed kernels of neem (*Azadirachta indica*) (Fares and others 1980) and is injected into the trunk of the tree.

Biological Control

Currently, three parasitoid wasps, including two gregarious larval endoparasitoid species (*Spathius agrili* and *Tetrastichus planipennisi*) and a solitary parthenogenic egg parasitoid (*Oobius agrili*) are available for release against EAB. The release and establishment of EAB natural enemies is not likely to provide any short-term control of EAB. This long-term approach is still experimental and will likely require a complex of natural enemies to maintain EAB below damaging levels. It may be years before these parasites can perpetuate themselves sufficiently before any level of success can be determined.

Recommendations

Because EAB is already active at the BL, we recommend that the BL develop a comprehensive ash/forest management plan and put a chemical suppression/prevention treatment plan into place as soon as possible. In addition, we recommend that the BL begin a public awareness campaign about EAB.

We recommend Alternative 2 based on the following considerations:

1) The high number of ash trees infested by EAB at the BL.
2) This alternative protects high-value ash trees and retains both large and smaller specimen trees.
3) We also recommend releasing available EAB parasitoids in infested areas that are not in proximity to chemical treatments. The establishment of these natural enemies is experimental, but may offer the opportunity for long-term control and may minimize the need for repeated chemical treatments in future years.

Species Evaluation

Emerald ash borer (EAB), *Agrilus planipennis* (Fairmaire), is a wood-boring beetle from Eastern Asia (Poland and McCullough 2006) that is causing severe mortality in North American ash (Tluczek and others 2011). EAB affects all species and diameter classes of ash and often kills both healthy and stressed trees within 3 to 5 years of their becoming infested (Siegert and others 2006).

Based on data from the USDA Animal and Plant Health Inspection Service, EAB emerges around mid-June and is present through mid-August (www.emeraldashborer.info). Adult beetles are slender, elongate, and bright green, and feed on ash foliage in patches along the leaf margins

(Kovacs and others 2010). Adult beetles usually live for about 3 weeks, and females lay about 60-90 eggs (McCullough and Katovich 2004). Eggs hatch in 7-10 days, and larvae chew through the bark and feed on phloem and outer sapwood for several weeks, creating S-shaped galleries packed with frass (Bauer and others 2004). Larvae are white to cream colored, have 10 segments, and are flattened. Larvae overwinter in shallow chambers in the outer sapwood or bark on thick-barked trees (Bauer and others 2004). EAB pupate in late April or May, and adults emerge 1-2 weeks after pupation through D-shaped exit holes (McCullough and Katovich 2004).

In addition to causing severe economic damage, there are ecological consequences associated with the loss of ash from North American forests. Studies show that ash trees provide food and habitat for several bird and mammal species (Faanes 1984, Rumble and Gobeille 1998). Forty-three native arthropod species are at high risk due to their association with ash for breeding or feeding (Gandhi and others 2010). Ash also contributes to nutrient cycling in hardwood forests (Reiners and Reiners 1970).

References

Bauer, L.S.; Haack, R.A.; Miller, D.L.; Petrice, T.R.; Liu, H. 2004. Emerald ash borer life cycle. In: Mastro, Victor; Reardon, Richard, comps. Emerald ash borer research and technology development meeting. FHTET–2004–02. Morgantown, WV: U.S. Forest Service, Forest Health Technology Enterprise Team: 8.

Faanes, C.A. 1984. Wooded islands in a sea of prairie – these isolated woodlands are important breeding habitat for northern prairie birds. American Birds. 38(1): 3–6.

Fares, Y.; Sharpe, P.J.H.; Magnuson, C. E. 1980. Pheromone dispersion in forests. Journal of Theoretical Biology. 84(2): 335–359.

Gandhi, K.J.K.; Cognato, A.I.; Lightle, D.M.; Mosley, B.J.; Nielsen, D.G.; Herms, D.A. 2010. Species composition, seasonal activity, and semiochemical response of native and exotic bark and Ambrosia beetles (Coleoptera: Curculionidae: Scolytinae) in northeastern Ohio. Journal of Economic Entomology. 103(4): 1187–1195.

Herms, D.A.; McCullough, D.G.; Smitley, D.R.; Sadof, C.S.; Cranshaw, W. 2014. Insecticide options for protecting ash trees from emerald ash borer. North Central IPM Center Bulletin. 2nd Edition. 16 p.

Kovacs, K.F.; Haight, R.G.; McCullough, D.G.; Mercader, R.J.; Siegert, N.W.; Liebhold, A.M. 2010. Cost of potential emerald ash borer damage in U.S. communities, 2009–2019. Ecological Economics. 69(3): 569–578.

McCullough, D.G.; Katovich, S.A. 2004. Pest Alert: emerald ash borer. NA–PR–02–04. U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry. 2 p.

Poland, T.M.; McCullough, D.G. 2006. Emerald ash borer: invasion of the urban forest and the threat to North America's ash resource. Journal of Forestry. 104(3): 118–124.

Reiners, W.A.; Reiners, N.M. 1970. Energy and nutrient dynamics of forest floors in three Minnesota forests. Journal of Ecology. 58(2): 497–519.

Ricketts, T., Dinerstein, E., Olson, D., Loucks, C., Eichbaum, W., Kavanagh, K.; Walters, S. 1999. A conservation assessment of the terrestrial ecoregions of North America. A report published by the World Wildlife Fund–US and Canada. Washington DC 681p.

Rumble, M.A.; Gobeille, J.E. 1998. Bird community relationships to succession in green ash (*Fraxinus pennsylvanica*) woodlands. American Midland Naturalist. 140: 372–381.

Siegert, N.W.; McCullough, D.G.; Liebhold, A.M.; Telewski, F.W. 2006. Spread and dispersal of emerald ash borer: a dendrochronological approach. In: Mastro, V.; Reardon, R.; Parra, G., comps. Emerald ash borer research and technology development meeting. FHTET–2005–

16. Morgantown, WV: U.S. Department of Agriculture, Forest Service, Forest Health Technology Enterprise Team: 10.

Tluczek, A.R.; McCullough, D.G.; Poland, T.M. 2011. Influence of host stress on emerald ash borer (Coleoptera: Buprestidae) adult density, development, and distribution in *Fraxinus pennsylvanica* trees. Environmental Entomology. 40(2): 357–366.

U.S. Department of Agriculture. 2001. Forest Inventory and Analysis Northeast Field Guide. Northern [Northeastern] Research Station, Forest Inventory and Analysis Unit: 298.

Wiken, E.; Nava, F.J.; Griffith, G. 2011. North American terrestrial ecoregions—level III. Montreal, Canada: Commission for Environmental Cooperation. 149 p.